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HUGHES

HUGHES AIRCRAFT COMPANY

INSTRUCTION MANUAL

HUGHES MILLIMETER-WAVE FULL BAND SWEEP GENERATOR MODEL 4772XH

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ELECTRON DYNAMICS DIVISION

3100 WEST LOMITA BOULEVARD, TORRANCE, CALIFORNIA 90509

INSTRUCTION MANUAL

HUGHES MILLIMETER-WAVE FULL BAND SWEEP GENERATOR

MODEL 4772XH

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1.0 GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains operating and service information for the Hughes 4772XH series of Millimeter-Wave, Full Band, Sweep Generators. The Sweep Generator consists of a Full Band Sweeper Plug-In, a Full Band Sweeper Source, a Leveling Loop, and an optional Hewlett-Packard Main Frame with optional IEEE bus compatibility. These components comprise a complete, electronically-tuned swept signal source at millimeter–wave frequencies (see Figure 1-1). Operating and service information for the Sweep Oscillator Main Frame is found in a separate manual.

This manual also includes an overall schematic diagram. Additional copies may be ordered separately from Hughes Aircraft Company, Electron Dynamics Division.

1.2 INSTRUMENTS COVERED BY THIS MANUAL

This manual applies directly to the instruments (with the exception of the Main Frame) which are shown in Figure 1-1. For instruments with model numbers other than these, consult Hughes Aircraft Company.

1.3 GENERAL DESCRIPTION

A block diagram of the full band sweep generator is shown in Figure 1-2. The Hewlett-Packard Model 8620C Main Frame, together with the Hughes Sweeper Plug-In, Sweep Source, and Leveling Loop, form a completely solid-state, self-contained, millimeter-wave sweep generator. The Modulator permits amplitude leveling and 1 kHz (or external) on/off modulation. Additional system capability in the 26.5 to 110 GHz range can be achieved by adding external Hughes accessories. These include isolators, couplers, mixers, and a complete line of direct reading attenuators, frequency meters, and phase shifters.

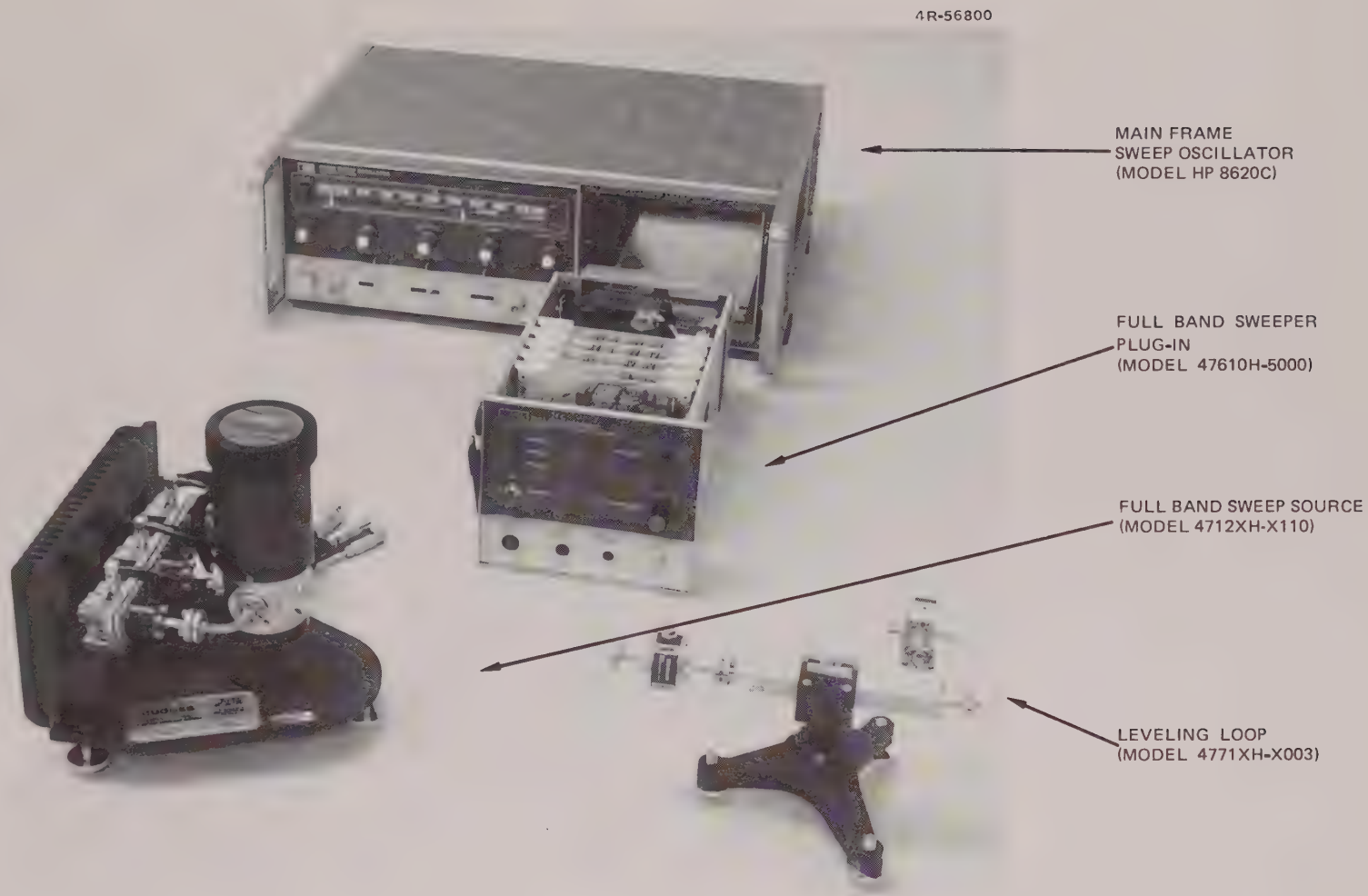

FIGURE 1-1. FULL BAND SWEEP GENERATOR WITH COMPONENT/ACCESSORY INSTRUMENTS

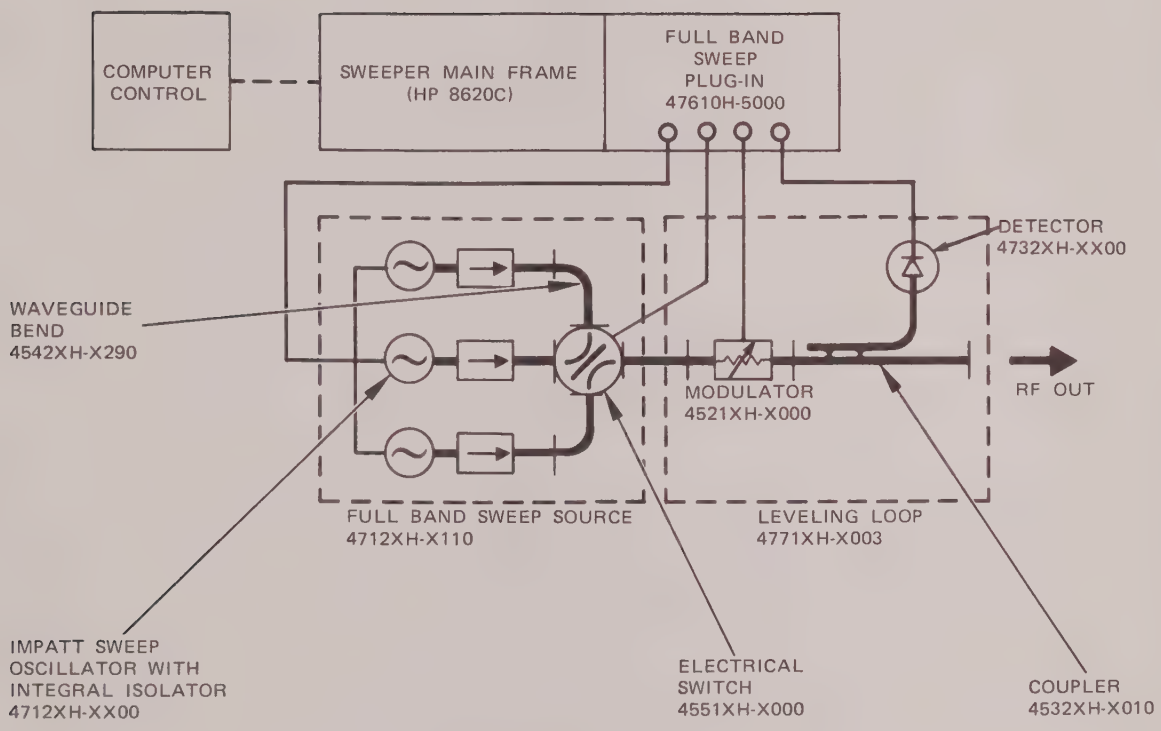

FIGURE 1-2. FULL BAND SWEEPER BLOCK DIAGRAM (4772XH-XXX0)

The automatic feature of this sweep generator allows the user to select the frequency span of interest by using the band select switch on the main frame. The 1% frequency linearity makes data interpretation simple and accurate.

The sweep generator may be ordered with the IEEE 488 bus compatibility option. This enables the user to configure an automated test station with full computer control.

1.3.1 Accessories Supplied

The following accessories are supplied with the sweeper:

1 each - Cable Harness*
3 each - Frequency Scales**
1 each - Instruction Manual
1 each - Power Cord (when Main Frame is ordered)

1.4 EQUIPMENT AVAILABLE

The appropriate sweeper sources, modulators, isolators, couplers and detectors which are available for the various frequency ranges are also described in the Hughes millimeter-wave catalogs which are available from Hughes Aircraft Company, Electron Dynamics Division.

1.5 RECOMMENDED TEST EQUIPMENT

Table 1-1 lists the equipment required to maintain the Full Band Sweep Generator. Other equipment may be substituted providing the specifications in the table are met or exceeded.

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*The Cable Harness is shipped attached to the sweep source.

**When the Main Frame is ordered, the scales are shipped already installed.

TABLE 1-1
RECOMMENDED TEST EQUIPMENT

Instrument	Critical Specifications	Recommended Model
Detector		Hughes 4732XH-XX00
Frequency Meter	Full Waveguide Bandwidth	Hughes 4571XH-X000
Variable Attenuator	0-50 dB Range, Full Waveguide Bandwidth	Hughes 4572XH-X000
Oscilloscope	Vertical Sensitivity: 1 mV/DIV Ext. Horizontal Input	Tektronix TM 922A
Power Meter and thermistor mount	+10 dBm to -20 dBm	HP 432 and Hughes 4577XH-X000
X-Y Recorder		HP 7035 B
Coupler		Hughes 4532XH-X010

1.6 TEST DATA PACKAGE

A test data package is shipped with each instrument. The test data sheets include power versus frequency curves for the three IMPATT sweepers.

1.7 SPECIFICATIONS

The specifications for the Hughes 4772XH Sweep Generator series are presented in Table 1-2.

NOTE

IMPATT sweeper sources have been supplied with integral isolators. Disconnecting an isolator from the source or disassembling an isolator will void the warranty on the source.

TABLE 1-2
HUGHES 4772XH FULL BAND SWEEP
GENERATOR SERIES SPECIFICATIONS

	Frequency (GHz)						
	Ka	Q	U	V	E	W	W
	(26.5-40)	(33-50)	(40-60)	(50-75)	(60-90)	(75-100)	(90-110)
Leveled Power Output (mW min)	2	2	2	2	2	1	1
Flatness (± dB max)	1.5	1.5	1.5	1.5	1.5	2.0	2.0
Scale Calibration (%)	1	1	1	1	1	1	1
Waveguide Size ①	WR-28	WR-22	WR-19	WR-15	WR-12	WR-10	WR-10
Waveguide Flange ①	UG-599/U ② UG-381/U ③	UG-383/U	UG-383/U (mod)	UG-385/U	UG-387/U	UG-387/U (mod)	UG-387/U (mod)

① Refer to back cover for specifications and MIL specification cross reference.
② Square flange ③ Round flange.

2.0 INSTALLATION

2.1 INITIAL INSPECTION

2.1.1 Mechanical Check

The instrument was carefully inspected before shipping; however, if damage to the shipping container is evident, request that a representative of the carrier be present when the container is opened. Check the instrument for mechanical damage such as broken or bent connectors, knobs, etc., including scratches or dents on the panel surface. If damage is found, refer to paragraph 2.1.3 for recommended claim procedure and paragraph 2.5.2 for repackaging instructions. If the shipping container is undamaged, check the packing material for signs of stress which may have been caused by rough handling. If the instrument appears undamaged, check for all supplied accessories, then perform the electrical check in paragraph 2.1.2.

2.1.2 Electrical Check

Check the electrical operation of the instrument as soon as possible after receipt by doing the Performance Tests (Section 4.0). The Performance Tests verify the electrical performance of the instrument and are suitable for incoming quality control inspection. If the instrument does not pass the Performance Tests, refer to paragraph 2.1.3 for recommended claim procedure and paragraph 2.5.2 for repacking instructions.

2.1.3 Claim For Damage

If physical damage is evident or if the instrument does not meet specifications when received, notify the carrier and the Hughes Aircraft Company, Electron Dynamics Division, to arrange for repair or replacement.

2.2 PREPARATION FOR USE

2.2.1 Power Requirements

All primary power required by the Sweep Plug-in is supplied by the Hewlett-Packard Main Frame.

2.3 INSTALLATION OF THE FREQUENCY SCALES

To install the frequency scales, proceed as follows:

NOTE

If RF Plug-in is installed in the Main Frame, it must be removed to install the frequency scale. See Section 2.4 for removal instructions.

a. Disengage Main Frame front panel latch handle (located on the upper left inside the plug-in compartment) by pushing downward on handle while pushing lightly inward on top of front panel.

b. Swing front panel forward and down.

c. Depress the band lever until the desired drum position is accessible from inside the Main Frame.

d. If applicable, remove the old frequency scale by exerting a pressure away from the drum on the right-hand edge of the scale.

NOTE

Drum positions 1 through 4 may be identified by tick marks (1, 11, 111, 1111) on left-hand side of drum.

e. Insert the frequency scale so that the key (a protrusion) fits into the notch on the left-hand side of the drum, then exert an inward pressure on the right hand edge of the frequency scale to snap it in place.

CAUTION

MAKE CERTAIN THAT THE FREQUENCY SCALE IS FIRMLY IN PLACE AND FLUSH WITH THE DRUM EDGES. IF NOT, THE POINTERS MAY BE DAMAGED WHEN THE DRUM IS ROTATED.

2.4 INSTALLATION OF THE FULL BAND SWEEEPER PLUG-IN

To install the Plug-in, proceed as follows:

a. Turn off power to the Main Frame.

b. Locate the drawer handle on the left side of the Plug-in. Position the handle so that the slot is towards the rear.

c. Slide the Plug-in into place towards the rear of the compartment until the latch handle starts to move down.

d. Press the latch handle downward while still pushing in on the Plug-in until the drawer latch is closed or flush with the front panel.

e. To remove Plug-in, repeat the procedure in reverse order.

2.5 STORAGE AND SHIPMENT

2.5.1 Shipping Environment

The instrument should be kept as free from dampness as possible to prevent voltage breakdown due to moisture.

2.5.2 Repacking

Original Packing - Original packing cartons and material are available from Hughes Aircraft Company. If the instrument is being returned for servicing, attach a tag indicating the following:

a. Model Number

b. Serial Number

c. Type of service required (as detailed as possible).

d. Return Address

e. Mark the carton "FRAGILE."

Other Packing Material - The following general instructions should be used for packing with commercial materials:

a. Wrap the instrument in heavy paper or plastic. Attach a tag indicating model number, serial number, type of service required, and return address.

b. Use a double-wall carton made of at least 350 pound test material.

c. Use enough shock-absorbing packing material on all sides to provide a firm cushion and prevent movement. Protect control panel and exposed parts and connectors with cardboard.

d. Include all cables, etc.

e. Seal the carton securely and stamp "FRAGILE."

f. When corresponding, always include model number and serial number and, if possible, a brief description of the type of problem encountered.

3.0 OPERATION

3.1 INTRODUCTION

This section describes the functions of the controls and indicators of the sweeper.

3.2 GENERAL PRECAUTIONS AND LABORATORY PRACTICES

a. Cable connections should always be minimized. Extraneous equipment may produce damaging transients.

b. Cable lengths should be minimized to prevent ground loops. Each cable has a resistance which, although small, may become significant when a long cable and high currents are used.

c. AC power cords should be connected to the same outlet or terminal strip to reduce the possibility of AC phasing and floating AC grounds.

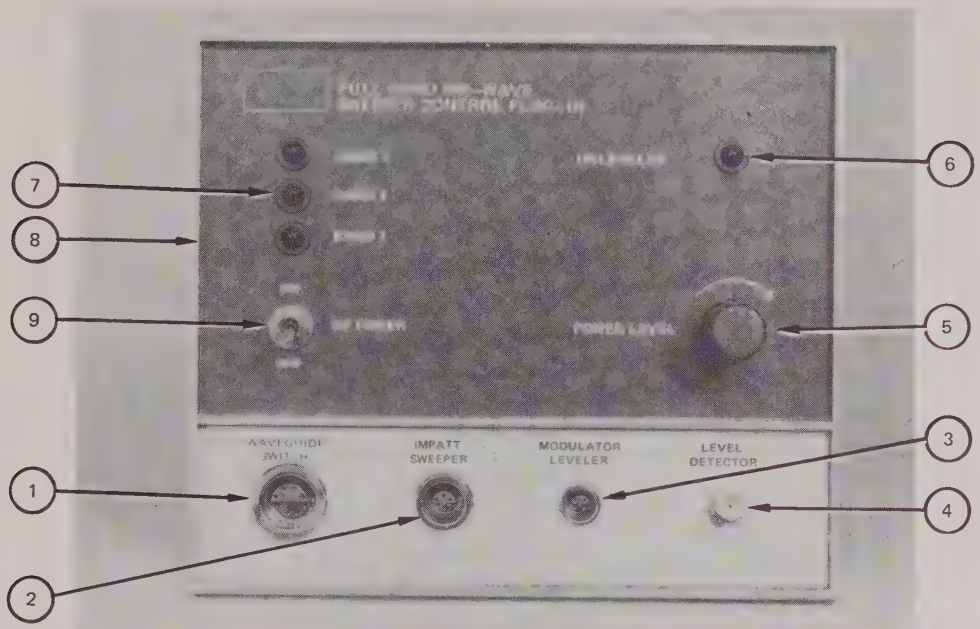
d. Auxiliary equipment, particularly those into high power switching, should not be used unless an analysis of their transients has been performed.

e. Bias should not be applied to detector diodes without consideration of the diode polarity, DC bias rating, or susceptibility to transients. Hughes diodes will generally accept -0.5 volts of reverse bias and +10 mA of forward bias and are very susceptible to voltage transients as those described above. RF power of 100 mW is a safe level and should not damage the diode unless a short circuit is presented across the output.

f. Mechanical force should never be applied to RF components or connectors. Each component should be properly supported and not expected to support heavier components.

3.3 PANEL FEATURES

Figures 3-1 and 3-2 describe the front and rear panel features, respectively. Each feature is described individually and listed by location number.



1. "WAVEGUIDE SWITCH" connector. Connection to waveguide switch for frequency band selection. Controlled automatically by Band select switch on Main Frame.

2. "IMPATT SWEEPER" connector. Connection to IMPATT oscillators. Supplies DC and sweep current to appropriate IMPATT oscillator as determined by Band select switch.

3. "MODULATOR LEVELER" connector. Connection to modulator. Used for RF leveling and square wave internal modulation. Can also be externally modulated from input on back of Main Frame.

4. "LEVEL DETECTOR" connector. Input from detector for RF power leveling.

5. "POWER LEVEL" control. Adjusts RF leveled power output.

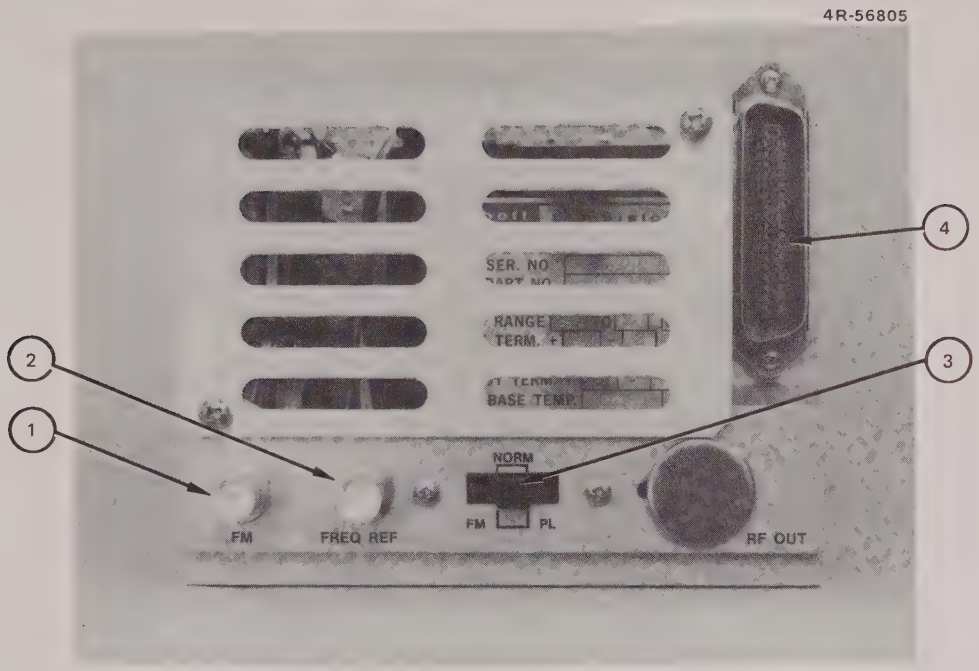
6. "UNLEVELED" indicator. Lights when no portion of the RF output is leveled.

7. "BAND" indicator. Light to indicate which of the three available frequency bands is operating.

8. Drawer Latching Handle. Push top of handle in, then pull out on bottom of handle to remove Plug-in.

9. "RF POWER" switch. Switches RF power "ON" and "OFF."

FIGURE 3-1. FRONT PANEL CONTROLS, CONNECTORS AND INDICATORS



1. "FM" Connector. Input from external modulation source of 0 to +10 volts will FM modulate the sweeper output. Full band modulation will occur with +10 volts input.

2. "FREQ REF" Connector. Provides a 0 to +10 volt output to drive an X-Y recorder. The output voltage is divided between Bands 1, 2 and 3 to allow the three power output curves to be plotted on a single graph.

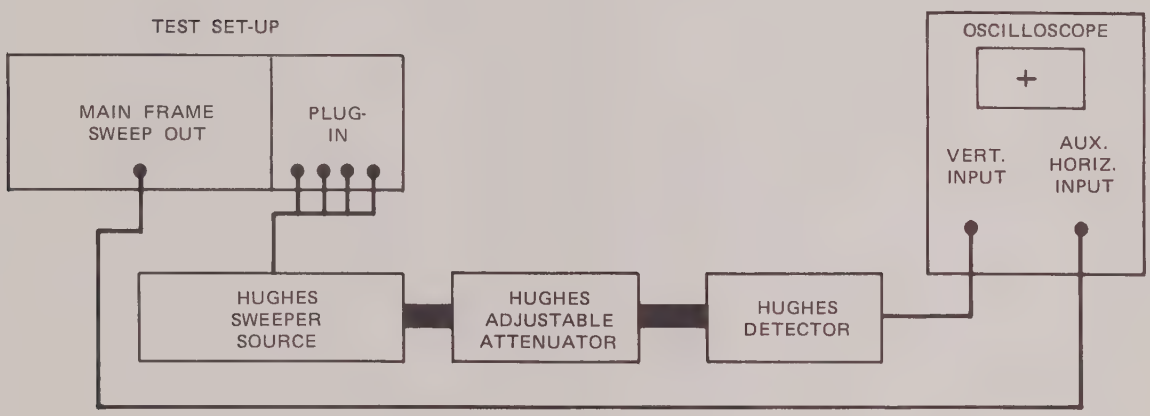
3. "FM/NORM" Switch. In the "FM" position, switches "FM" connector into circuit. In "NORM" position, the "FM" connector is deactivated.

4. Interface Connector J1. Provides interconnection between Main Frame and Plug-in.

FIGURE 3-2. REAR PANEL CONTROLS AND CONNECTORS

3.4 OPERATOR'S CHECK

Figure 3-3 is the operator's checkout procedure. This allows the operator to make a quick check of all the main instrument functions prior to use. If a more detailed checkout is desired, refer to Section 4.0, Performance Tests.



EQUIPMENT:

Main Frame	HP 8620 C
Full Band Sweeper Source	Hughes 4772XH-XXX0
Variable Attenuator	Hughes 4572XH-X000
Detector	Hughes 4732XH-XX00
Oscilloscope	Tektronix TM 922 A

FIGURE 3-3. OPERATOR'S CHECK (1 of 3).

PROCEDURE:

1. Connect equipment as shown.
2. Set controls as follows:

MAIN FRAME

BAND	Desired IMPATT Frequency
START MARKER	Low frequency end of band
STOP MARKER	High frequency end of band
MODE SWITCH	AUTO
TIME SWITCH	0.01 sec
TIME-SECONDS Vernier	Fully clockwise
TRIGGER	LINE
BLANKING (Rear Panel)	ON
MARKERS	OFF

PLUG-IN

RF POWER	OFF
POWER LEVEL	Fully clockwise

3. Press the LINE pushbutton switch to turn the instrument on. With the line switch ON, the LINE pushbutton and the FULL SWEEP pushbutton lights should illuminate.
4. Adjust oscilloscope horizontal input so the displayed line starts and stops on the screen.
5. Set oscilloscope vertical scale to 5 mV/div.
6. Set RF attenuator for maximum attenuation.
7. Turn the RF POWER Switch on. The UNLEVELED light should light.
8. Decrease RF attenuation until sweep is displayed on the oscilloscope.
9. Check the oscilloscope display for a continuous signal above zero volts.
10. Set the Main Frame MODE Switch to MANUAL and adjust the MANUAL CONTROL VERNIER. The trace dot should move across the oscilloscope display.

FIGURE 3-3. OPERATOR'S CHECK (2 OF 3).

11. Return MODE Switch to AUTO.

12. Depress the MAIN FRAME CW Switch. The oscilloscope trace should be a dot. Change frequency with CW MARKER control and the dot should move across the oscilloscope display.

13. Depress the Main Frame ΔF Switch and set the ΔF MARKER to approximately its mid-scale.

14. Adjust the Main Frame CW MARKER control between minimum and maximum. The sweep trace displayed on the oscilloscope should change as the CW MARKER control is adjusted. The frequency spread is varied by adjusting the ΔF MARKER CONTROL.

15. Depress MARKER SWEEP Switch and vary the START MARKER and STOP MARKER controls. The sweep trace displayed on the oscilloscope should change.

16. Depress FULL SWEEP pushbutton. From the fully clockwise position, slowly adjust the POWER LEVEL control counterclockwise. Notice that the UNLEVELED light becomes dimmer and finally goes out. With the light off, the output is leveled across the sweeping band. Return the control back to the fully clockwise position.

17. Move MARKER switch to AMPL. Adjust the CW MARKER, the START MARKER, and the STOP MARKER from end to end. An amplitude dip should move across the oscilloscope.

18. Repeat the above procedure for the other two bands.

FIGURE 3-3. OPERATOR'S CHECK (3 OF 3).

4.0 PERFORMANCE TESTS

4.1 INTRODUCTION

The performance tests in this section verify that the sweeper meets the specifications listed in Table 1-1. These tests may be used for incoming inspection, after repair of the instrument, after performing the alignment procedure, or for periodic evaluation. If only a simple check of the instrument is required, refer to the operator's check in paragraph 3.4. If a test measurement is beyond acceptable limits, perform the appropriate adjustment procedure in Section 5.0.

4.2 EQUIPMENT REQUIRED

A complete list of the test equipment required for the performance tests is given in Table 1-2. If the recommended equipment in the list is not available, a substitute may be used, provided it meets or exceeds the critical specifications listed in the table.

4.3 PERFORMANCE TESTS INSTRUCTIONS

The following tests will measure the frequency coverage, leveled output power, output power flatness, and frequency scale calibration accuracy. If any of the specifications are beyond the limits of Table 1-1, refer to Section 5.0 for adjustments. Refer to Figure 4-1 for the test set-up and Table 1-2 for the equipment list. Initially, set the controls as follows:

MAIN FRAME

BAND	BAND 1
START MARKER	Low frequency end of Band
STOP MARKER	High frequency end of Band
MODE SWITCH	AUTO
TIME SWITCH	0.01 sec
TIME-SECONDS Vernier	Fully clockwise

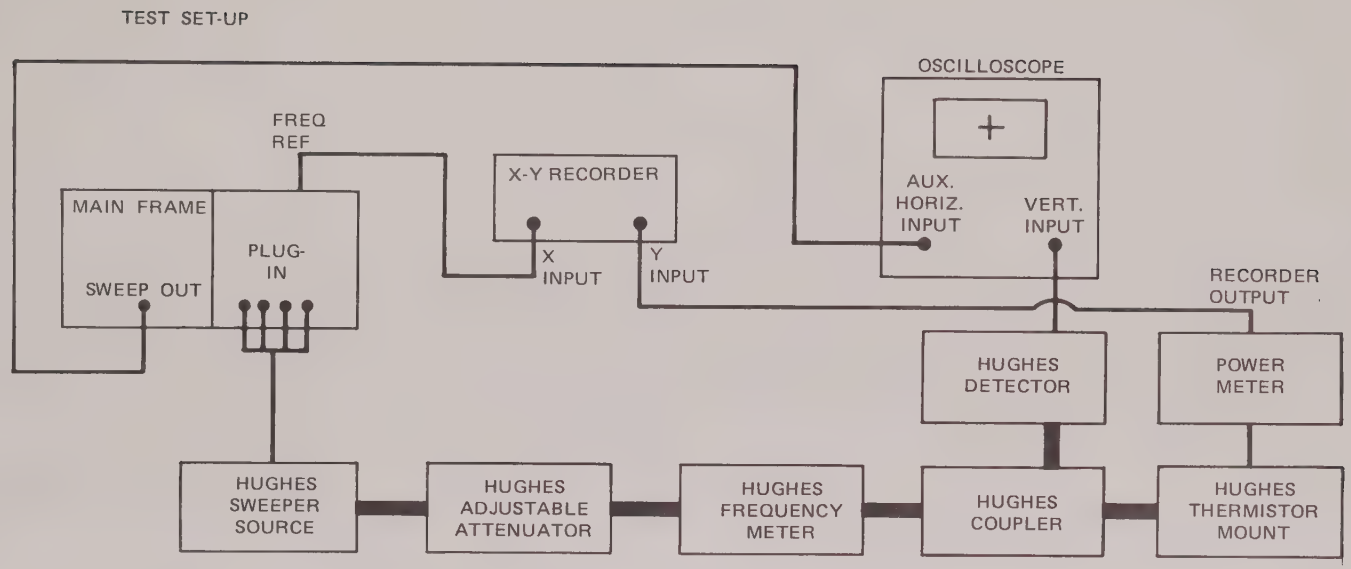


FIGURE 4-1. PERFORMANCE TEST SET-UP

TRIGGER . . . . . Line
BLANKING (rear panel) . . . . . ON
MARKERS . . . . . OFF

PLUG-IN

RF POWER . . . . . OFF
POWER LEVEL Fully clockwise . . . . . Fully clockwise

X-Y RECORDER

X-INPUT . . . . . 0-10 volts full scale
Y-INPUT . . . . . 0-1 volt full scale
POWER/SERVO . . . . . ON/OFF

POWER METER

RANGE . . . . . 10 mW

At this time, if it has not already been done, the operator's check, paragraph 3.4, lines 3 through 17, should be performed. This will give a check of the test set-up and all the main instrument functions. Upon completion of this test, return all controls to the above settings and proceed with the performance tests.

4.3.1 Frequency Range And Scale Calibration Accuracy Tests

These tests will use the CW mode to check three frequencies across the band to determine if the dial calibration is within tolerance. Also, the frequency end points will be checked to determine if the proper frequency range is covered.

NOTE

Allow the instrument to warm up for 30 minutes prior to starting test.

PROCEDURE:

1. Depress the CW switch on the Main Frame. Set the CW MARKER to the lowest indicated frequency and measure the frequency with the frequency meter. The measured frequency should be within 1% of the scale indication.

2. Repeat the above procedure with the CW MARKER set at mid-scale.

3. Repeat the above procedure with the CW MARKER set at the highest indicated frequency. Again, the measured frequency should be within 1% of the scale indication.

4. Depress the FULL SWEEP switch. Using the sweep display on the oscilloscope and the frequency meter measure the lowest and the highest frequencies of the sweep. The combined swept frequency from the three bands should cover the entire specified frequency range within the 1% accuracy.

5. Repeat steps 1 thru 4 for Band 2 and Band 3.

4.3.2 Output Power And Power Flatness Tests

These tests will measure the leveled output power of the sweep source and the power flatness across the band. In these tests the thermistor, with its correction factor, is used as the standard for the power measurement.

NOTE

Allow the instrument to warm up for 30 minutes prior to starting test.

4.3.2.1 Test Line Insertion Loss Calibration

This test sets the insertion loss of the test line at 10.0 dB. This will allow accurate power measurements to be taken.

PROCEDURE:

1. Start with the instrument settings that are listed in paragraph 4.3.
2. Turn power level fully counterclockwise and switch RF POWER to ON. Depress the CW switch and set the CW MARKER somewhere in mid-band.
3. Disconnect the thermistor mount from the coupler and the adjustable attenuator from the sweeper source.
4. Connect the thermistor mount to the end of the sweeper source (it will be attached to the end of the coupler of the leveling loop).
5. Turn up the POWER LEVEL until the power meter reads above mid-scale. If this can't be done, turn the power meter down one range. Record the power meter reading.
6. Switch the RF power to OFF and reconnect the test line as shown in Figure 4-1.
7. Turn the power meter down two ranges, switch the RF POWER to ON, and adjust the attenuator for the same scale reading as step 5. The setting on the attenuator is now calibrated to give 10 dB insertion loss in the test line (e.g., a 0.3 mW reading on the power meter is actually 3 mW).

NOTE

To measure the actual power, the correction factor of the thermistor mount, at the measurement frequency, must be added to the power meter reading.

4.3.2.2 Output Power And Power Flatness Test Procedure

1. Set the instruments controls as in paragraph 4.3.

2. Turn the sweeper on and switch the RF POWER to ON. The FULL SWEEP pushbutton light should be on.

3. Slowly turn the POWER LEVEL control counterclockwise until the UNLEVELED light goes out. The output of the sweeper source is now leveled.

4. Turn the power meter RANGE to 1 mW and switch the Main Frame MODE switch to MANUAL. Turn the manual control from the low end of the frequency range to the high end. The power should read between 1 and 10 mW. If it is above 10 mW, switch meter to the 10 mW scale.

5. Switch the MODE switch back to AUTO. Switch the TRIGGER switch to EXT, and move the POWER/SERVO switch on the X-Y Recorder to ON/ON.

6. Set the TIME/SECONDS switch to 10, zero the X-Y recorder, switch the pen DOWN, and trigger the SINGLE sweep switch on the Main Frame. The X-Y Recorder will now plot power versus frequency for Band 1 on the first third of the graph paper. When Band 2 and Band 3 are swept, the FREQ REF of the Plug-in will supply the proper voltage to the X-Y Recorder to give one full curve. Figure 4-2 is a typical plot of power versus frequency for a 3 Band Sweeper.

7. The proper correction factors of the thermistor mount must be added to the plot from step 6. This will give the actual curve. From this curve, the output power and flatness specifications can be verified.

8. Repeat paragraphs 4.3.2.1 and 4.3.2.2 for BAND 2 and BAND 3. Do not zero the X-Y Recorder in Step 6 of paragraph 4.3.2.2.

NOTE

The power measurements taken in this paragraph assume a 10-dB test line insertion loss. This was measured only at mid-band, but it is reasonably accurate across each band. If more accurate data are required, the insertion loss will have to be measured at more points across the band.

DATA TAKEN AT 25°C AMBIENT AFTER AN 8 HOUR MINIMUM BURN-IN.

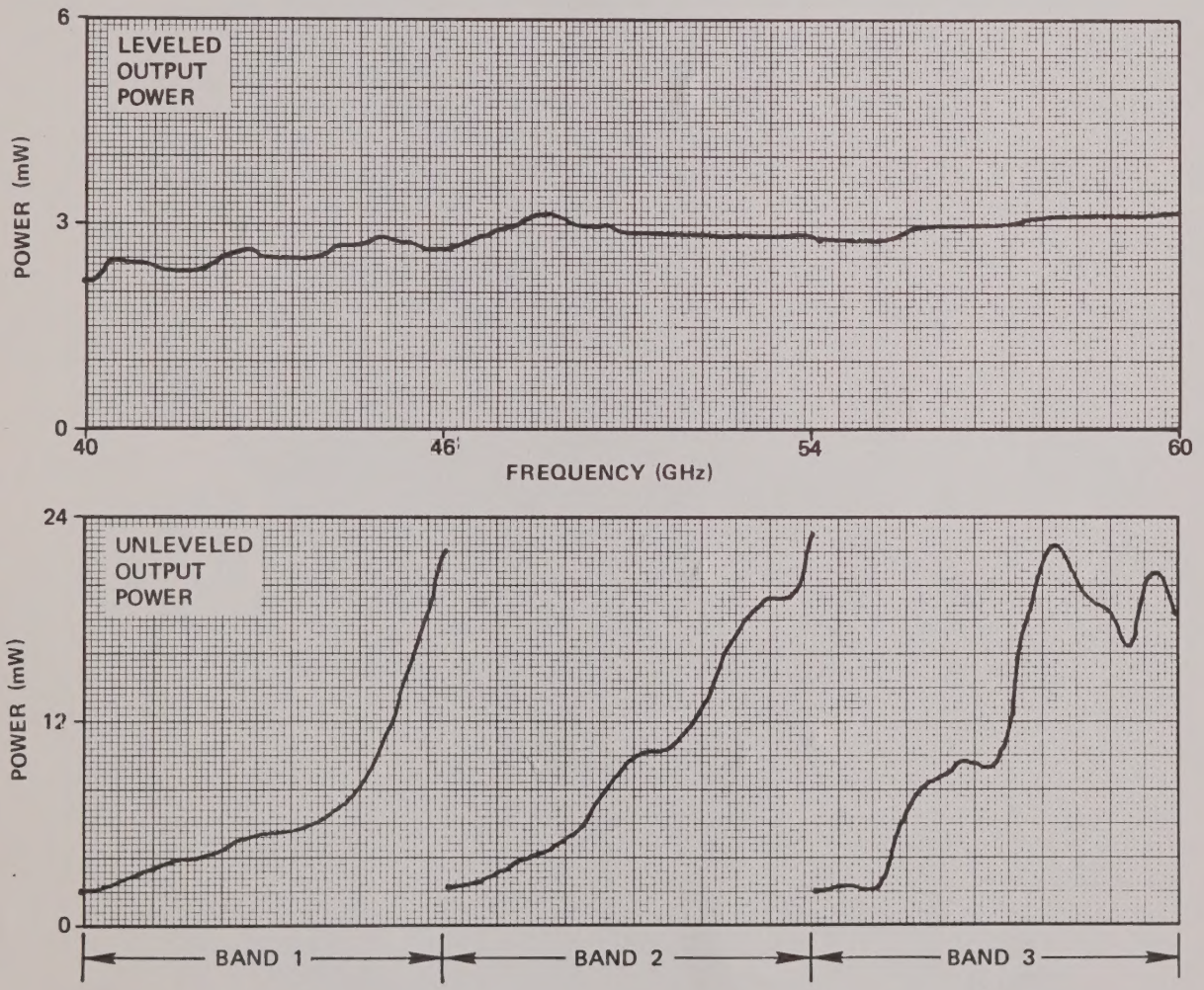


FIGURE 4-2. TYPICAL OUTPUT POWER VS FREQUENCY FOR A FULL BAND SWEEPER

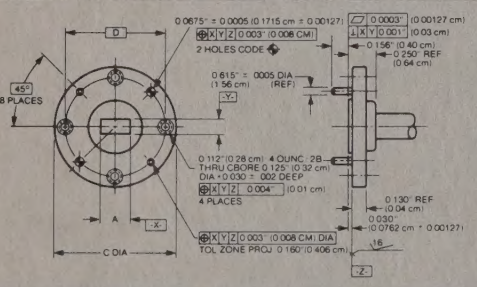
Waveguide Specifications and MIL Specification Cross Reference

Band Designation	Frequency (GHz)	MIL-W-85/ X-XXX (Silver)①	Waveguide Specifications				Flange Specifications		
			Inside Dimensions (inches (cm))		Outside Dimensions (inches (cm))		MIL-F-3922/ XX-XXX (Brass)①	UG-XXX/U Equivalent (REF)	Remarks
			a x b	tol ±	a x b	tol ±			
K	18-26.5	1-106 (WR-42)	0.420 x 0.170 (1.07 x 0.43)	0.0020 (0.0051)	0.500 x 0.250 (1.27 x 0.635)	0.0030 (0.0076)	54-001 67-004	UG-595/U —	Square② Round
Ka	26.5-40	3-006 (WR-28)	0.280 x 0.140 (0.711 x 0.356)	0.0015 (0.0038)	0.360 x 0.220 (0.914 x 0.559)	0.0020 (0.0051)	54-003 68-002 67B-005	UG-599/U — UG-381/U	Square Square③ Round
Q	33-50	3-010 (WR-22)	0.224 x 0.112 (0.57 x 0.28)	0.0010 (0.0025)	0.304 x 0.192 (0.772 x 0.488)	0.0020 (0.0051)	67B-006	UG-383/U	Round
U	40-60	3-014 (WR-19)	0.188 x 0.094 (0.48 x 0.24)	0.0010 (0.0025)	0.268 x 0.174 (0.681 x 0.442)	0.0020 (0.0051)	67B-007	UG-383/U Mod	Round
V	50-75	3-017 (WR-15)	0.148 x 0.074 (0.38 x 0.19)	0.0010 (0.0025)	0.228 x 0.154 (0.579 x 0.391)	0.0020 (0.0051)	67B-008	UG-385/U	Round
E	60-90	3-020 (WR-12)	0.122 x .061 (0.31 x 0.15)	0.0005 (0.0127)	0.202 x 0.141 (0.513 x 0.356)	0.0020 (0.0051)	67B-009	UG-387/U	Round
W	75-110	3-023 (WR-10)	0.100 x 0.050 (0.254 x 0.127)	0.0005 (0.127)	0.180 x 0.130 (0.458 x 0.330)	0.0020 (0.0051)	67B-010	UG-387/U Mod	Round
F	90-140	3-026 (WR-8)	0.80 x 0.040 (2.032 x 0.102)	0.0003 (0.0008)	0.160 x 0.120 (0.406 x 0.305)	0.0015 (0.0038)	— 74-001	UG-387/U Mod	Round Pin Contact
D	110-170	3-029 (WR-6)	0.065 x 0.0325 (0.17 x 0.083)	0.0003 (0.0008)	0.145 x 0.1125 (0.368 x 0.2858)	0.0015 (0.0038)	— 74-002	UG-387/U Mod	Round Pin Contact
G	140-220	3-032 (WR-5)	0.051 x 0.0255 (0.130 x 0.0648)	0.0003 (0.0008)	0.131 x 0.1055 (0.333 x 0.2680)	0.0015 (0.0038)	— 74-003	UG-387/U Mod	Round Pin Contact

① All waveguide and flange assemblies are gold plated per MIL Spec MIL-G-45204 ② Also available with #4-40 threaded holes instead of through holes ③ Threaded holes

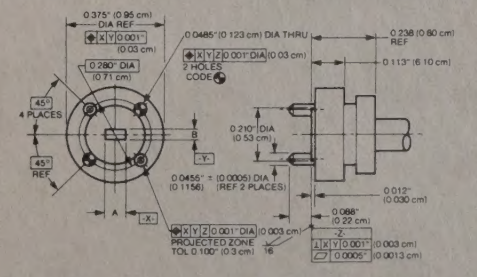
OUTLINE AND MOUNTING DRAWINGS

Round



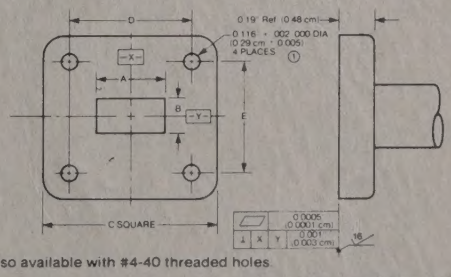
DIMENSIONS (inches (cm))				
BAND	A	B	C dia	D dia
K	0.420 (1.07)	0.170 (0.43)	1.125 (2.86)	0.9375 (2.38)
Ka	0.280 (0.71)	0.140 (0.36)	1.125 (2.86)	0.9375 (2.38)
Q	0.224 (0.57)	0.112 (0.28)	1.125 (2.86)	0.9375 (2.38)
U	0.188 (0.48)	0.094 (0.24)	1.125 (2.86)	0.9375 (2.38)
V	0.148 (0.38)	0.074 (0.19)	0.750 (1.91)	0.5625 (1.43)
E	0.122 (0.31)	0.061 (0.15)	0.750 (1.91)	0.5625 (1.43)
W	0.100 (0.25)	0.050 (0.13)	0.750 (1.91)	0.5625 (1.43)
F	0.080 (0.23)	0.040 (0.10)	0.750 (1.90)	0.5625 (1.43)
D	0.065 (0.17)	0.0325 (0.083)	0.750 (1.90)	0.5625 (1.43)
G	0.051 (0.13)	0.0255 (0.064)	0.750 (1.90)	0.5625 (1.43)

Pin Contacts



DIMENSIONS (inches (cm))		
BAND	A	B
F	0.080 (0.20)	0.040 (0.10)
D	0.063 (0.16)	0.0325 (0.083)
G	0.051 (0.13)	0.0253 (0.064)

Square



① Also available with #4-40 threaded holes.

DIMENSIONS (inches (cm))						
BAND	A	B	C	D	E	
K	0.420 (1.07)	0.170 (0.43)	0.875 (2.22)	0.640 (1.63)	0.670 (1.70)	
Ka	0.280 (0.71)	0.140 (0.36)	0.750 (1.91)	0.500 (1.27)	0.530 (1.35)	

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